

Reference

NBS  
Publi-  
cations

NAT'L INST. OF STAND & TECH R.I.C.



A11104 742727

NBSIR 79-1745

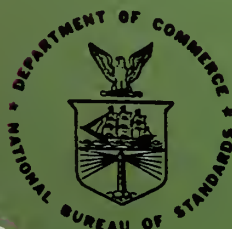
# Fire Research Publications, 1978

Nora H. Jason

Center for Fire Research  
National Engineering Laboratory  
National Bureau of Standards  
Washington, D.C. 20234

April 1979

Final Report



QC  
100  
.U56  
79-1745

U.S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS



National Bureau of Standards  
MAY 22 1979  
not hrc- RIF  
2000  
USG  
97-1745

NBSIR 79-1745

**FIRE RESEARCH PUBLICATIONS, 1978**

Nora H. Jason

Center for Fire Research  
National Engineering Laboratory  
National Bureau of Standards  
Washington, D.C. 20234

April 1979

Final Report

**U.S. DEPARTMENT OF COMMERCE, Juanita M. Kreps, *Secretary***  
**Jordan J. Baruch, *Assistant Secretary for Science and Technology***  
**NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director***



"Fire Research Publications, 1978" is a supplement to the previous editions:

|         |               |                |              |        |
|---------|---------------|----------------|--------------|--------|
| 1969-72 | NBSIR 73-246  | NTIS Order No. | COM-74-10989 | \$3.25 |
| 1973    | NBSIR 74-511  |                | COM-74-11448 | \$3.25 |
| 1974    | NBSIR 75-736  |                | COM-75-11018 | \$3.25 |
| 1975    | NBSIR 76-1120 |                | PB-257837    | \$3.50 |
| 1976    | NBSIR 77-1277 |                | PB-269965    | \$3.50 |
| 1977    | NBSIR 78-1504 |                | PB-284462    | \$4.00 |

Only publications prepared by members of the Center for Fire Research (CFR), by other National Bureau of Standards (NBS) personnel or external laboratories under contract or grant from the CFR are cited. Articles published in NBS house organs also are cited.

For documents that are available for purchase from either the Government Printing Office (GPO) or the National Technical Information Service (NTIS), the specific order number and paper copy price (prices are subject to change) have been included in the citation.

GPO documents are obtained by writing directly to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Indicate the SD Catalog No. for each document requested. Orders must be prepaid. Remittance should be made by check or money order payable to the "Superintendent of Documents, U.S. Government Printing Office."

NTIS documents are obtained by writing directly to the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161. Indicate the NTIS Order No. for each document requested. Microfiche copies of the documents also are available at a cost of \$3.00 for domestic orders. All prices are subject to change. Orders must be prepaid by check or money order payable to "National Technical Information Service" or by utilizing an NTIS form with your deposit account number.

## TABLE OF CONTENTS

|                                                               | Page |
|---------------------------------------------------------------|------|
| I. Journal Articles and Conference Proceedings . . . . .      | 1    |
| II. National Bureau of Standards Publications . . . . .       | 4    |
| A. Dimensions/NBS . . . . .                                   | 4    |
| B. National Bureau of Standards Interagency Reports . . . . . | 5    |
| C. National Bureau of Standards Technical Notes . . . . .     | 6    |
| III. Contract and Grant Reports . . . . .                     | 7    |
| IV. Author Index . . . . .                                    | 10   |

## I. Journal Articles and Conference Proceedings

- Ahmad, T. and Faeth, G.M. An Investigation of the Laminar Overfire Region Along Upright Surfaces. Journal of Heat Transfer, Vol. 100, No. 1, 112-119, February 1978.
- Anderson, R.C. and Alarie, Y.C. Approaches to the Evaluation of the Toxicity of Decomposition Products of Polymeric Materials Under Thermal Stress. Journal of Combustion Toxicology, Vol. 5, 111-129, 1978.
- Anderson, R.C. and Alarie, Y.C. Screening Procedure to Recognize "Supertoxic" Decomposition Products from Polymeric Materials Under Thermal Stress. Journal of Combustion Toxicology, Vol. 5, 54-63, February 1978.
- Anderson, R.C., Dierdorf, J., Stock, M.F., Matijak, M., Sawin, R. and Alarie, Y. Use of Experimental Materials to Assess the Ability of Toxicological Testing Schemes in Rating the Hazards of Polymeric Materials Under Thermal Stress. Fire and Materials, Vol. 2, 136-140, 1978.
- Bankston, C.P., Zinn, B.T., Browner, R.F. and Powell, E.A. Fundamental Aspects of the Mechanisms of Smoke Generation by Burning Materials. In: Combustion Institute. Eastern States Section. Miami Beach, Florida, November 29, 30, December 1, 1978.
- Barrow, C.S., Alarie, Y. and Stock, M.F. Sensory Irritation and Incapacitation Evoked by Thermal Decomposition Products of Polymers and Comparisons with Known Sensory Irritants. Archives of Environmental Health, Vol. 33, 79-88, 1978.
- Benjamin, I.A. Fire Safety of Polymeric Materials in Buildings - State-of-the-Art. In: American Chemical Society. National Symposium on Fire Safety Aspects of Polymeric Materials. Washington, D.C. June 6-8, 1977. Proceedings.
- Bright, R.G. Do Gas Sensors Meet Smoke Detector Requirements? Fireline, Vol. 3, No. 3, 5-7, 15, May-June 1978.
- Bright, R.G. Technical Developments of Domestic Fire Detectors. In: International Fire, Security and Safety Exhibition and Conference, London, April 24-28, 1978. Proceedings.
- Brown, N.J., Eberius, K.H., Fristrom, R.M., Hoyermann, K.H. and H.Gg. Wagner. Low-Pressure Hydrogen/Oxygen Flame Studies. Combustion and Flame, Vol. 33, 151-160, 1978.
- Brown, N.J. and Fristrom, R.M. A Two Zone Model of Flame Propagation Applied to  $H_2$  + Air Flames and HCl Inhibited Flames. Fire and Materials, Vol. 2, No. 3, 117-121, 1978.

- Browner, R.F. and Liao, J.C. Determination of Polynuclear Aromatic Hydrocarbons in Poly(vinyl chloride) Smoke Particulates by High Pressure Liquid Chromatography and Gas Chromatography-Mass Spectrometry. Analytical Chemistry, Vol. 50, 1683-1686, October 1978.
- Bushev, V.P., Pchelintsev, V.A., Fedorenko, V.S. and Yakovlev, A.I. Fire Resistance of Buildings. 2d Edition, Revised and Supplemented. (Construction Literature Publishers, Moscow, 1970) Translated from the Russian. Published by Amerind Publishing Co. Pvt. Ltd., New Delhi, 1978. NTIS Order No. TT 73-52030; \$9.50.
- Chien, J.C.W. and Kiang, J.K.Y. Pyrolysis and Oxidative Pyrolysis of Polypropylene. In: Advances in Chemistry Series, No. 169, Stabilization and Degradation of Polymers. David L. Allars and Walter L. Hawkins, Editors. American Chemical Society, pp 175-197. 1978.
- Chow, L.C. and Tien, C.L. An Examination of Four Differencing Schemes for Some Elliptic-type Convection Equation. Numerical Heat Transfer, Vol. 1, 87-100, 1978.
- Evans, D.D. and Breden, L.H. Time Delay Correction for Heat Release Rate Data. Fire Technology, Vol. 14, No. 2, 85-96, May 1978.
- Davis, S. Assessment of Fire Hazards of Furniture. In: International Fire Security and Safety Exhibition and Conference. London, April 24-28, 1978. Proceedings.
- Fristrom, R.M. The Problems, Language and Scientific Basis of Flammability Testing. IEEE Transactions of Electrical Insulation, Vol. EI-13, No. 5, 367-375, October 1978.
- Gross, D. Measurements of Fire Loads and Calculations of Fire Severity. Wood and Fiber, Vol. 9, No. 1, Special Fire Symposium Issue, Part 1, 72-85, Spring 1977.
- Kashiwagi, T. Experimental Observation of Radiative Ignition Mechanisms. In: Combustion Institute. Western States Section. In-Situ Combustion Technology Ignition and General Combustion Topic. Boulder, Colorado. April 17-18, 1978.
- Kauffman, C.W., Ural, E., VanDyk, R. and Nicholls, J.A. The Explosive Combustion of Coal Dust. In: Combustion Institute. Eastern States Section. Miami Beach, Florida, November 29, 30, December 1, 1978.
- Levin, B. and Vreeland, R. Arsonists: Who and Why - The Minds and Motives of People Who Set Fires. Firehouse, Vol. 4, No. 8, 16, 51, August 1978.

- Levine, R.S. Mathematical Fire Modeling. In: American Chemical Society. National Symposium on Fire Safety Aspects of Polymeric Materials. Washington, D.C., June 6-8, 1977. Proceedings.
- Liburdy, J.A. and Faeth, G.M. Heat Transfer and Mean Structure of a Turbulent Thermal Plume Along a Vertical Isothermal Wall. Journal of Heat Transfer, Vol. 100, 177-183, May 1978.
- Lyons, J.W. Some Guiding Principles in Fire Testing and Standards. In: American Chemical Society. National Symposium on Fire Safety Aspects of Polymeric Materials. Washington, D.C., June 6-8, 1977. Proceedings.
- Miles, L.B. An Investigation of the Flammability Hazard of Apparel Fires. In: Symposium on Textile Flammability, 1978. R.B. LeBlanc, Editor. Proceedings. New York, April 19-20, 1978.
- Manka, M.J. Yeh, K. and Smith, B.F. A Calorimetric Study of Flame-Retardant Treated Cotton/Polyester Blends. Journal of Fire Retardant Chemistry, Vol. 5, 144-159, August 1978.
- McCarter, R.J. Smoldering Combustion of Wood Fibers: Cause and Prevention. Journal of Fire and Flammability, Vol. 9, 119-126, January 1978.
- Quintiere, J., McCaffrey, B.J. and Kashiwagi, T. A Scaling Study of a Corridor Subject to a Room Fire. Combustion Science and Technology, Vol. 18, 1-19, 1978.
- Quintiere, J.G., McCaffrey, B.J. and Rinkinen, W. Visualization of Room Fire Induced Smoke Movement and Flow in a Corridor. Fire and Materials, Vol. 2, No. 1, 18-24, 1978.
- Rehm, R.G. and Baum, H.R. The Equations of Motion for Thermally Driven Buoyant Flows. Journal of Research of the National Bureau of Standards, Vol. 83, 297-308, May-June 1978.
- Rowen, J.W. and Lyons, J.W. The Importance of Externally Improved Heat Flux on the Burning Behavior of Materials. Journal of Cellular Plastics, Vol. 14, 25-32, January/February 1978.
- Schenck, P.K., King, D.S., Smyth, K.C., Travis, J.C. and Turk, G.C. New Analytic and Spectroscopic Tool--The Opto-Galvanic Effect. In: Royal Institution. Lasers in Chemistry. Edited by M.A. West. London, May 31-June 2, 1977. Proceedings.
- Schenck, P.K., Mallard, W.G., Travis, J.C. and Smyth, K.C. Absorption Spectra of Metal Oxides Using Optogalvanic Spectroscopy. Journal of Chemical Physics, Vol. 69, No. 11, 5147-5150, December 1978.
- Schenck, P.K. and Smyth, K.C. Opto-Galvanic Spectroscopy of Atomic Neutrals and Ions in Discharges. Journal of the Optical Society of America, Vol. 68, 626-627, 1978.

- Sebata, K., Magill, J. and Alarie, Y. Thermal Stability and Toxicity of Polymers: Polyphos-phazenes. Journal of Fire and Flammability, Vol. 9, 50-70, 1978.
- Shafizadeh, F. Combustion, Combustibility, and Heat Release of Forest Fuels. AiChE Symposium Series, No. 177, Vol. 74, 76-82, 1978.
- Shafizadeh, F., Lai, Y.Z. and McIntyre, C.R. Thermal Degradation of 6-Chlorocellulose and Cellulose-Zinc Chloride Mixture. Journal of Applied Polymer Science, Vol. 22, 1183-1193, 1978.
- Smyth, K.C., Keller, R.A. and Crim, F.F. Photon-Induced Ionization Changes in a Neon Discharge. Chemical Physics Letters, Vol. 55, No. 3, 473-477, May 1, 1978.
- Smyth, K.C. and Schenck, P.K. Opto-Galvanic Spectroscopy of a Neon Discharge: Mechanism Studies. Chemical Physics Letters, Vol. 55, No. 3, 466-472, May 1, 1978.

## II. National Bureau of Standards Publications

### A. Dimensions/NBS

- Chabay, I., Rosasco, G.J. and Kashiwagi, T. Non-Intrusive Technique Measures Concentration Fluctuations in Turbulent Gas Flow. Dimensions/NBS, Vol. 62, No. 4, 22-23, April 1978. GPO; \$1.05.
- Chaffee, D. NBS Research Associate Maurice Ducloux: The French Connection. Dimensions/NBS, Vol. 62, No. 5, 16, May 1978. GPO; \$1.05.
- Chaffee, D. New Instrument for Field Testing Smoke Detectors. Dimensions/NBS, Vol. 62, No. 4, 20, April 1978. GPO; \$1.05.
- Chaffee, D. Science for Life. Dimensions/NBS, Vol. 62, No. 7/8, 10-15, July/August 1978. GPO; \$1.05.
- Heyman, M. Insulation Insomnia: A Cure! Dimensions/NBS, Vol. 62, No. 9, 7-13, September 1978. GPO; \$1.05.
- Schenck, P.K., Travis, J.C., Smyth, K.C., and King, D.S. A New Analytical and Spectroscopic Tool: The Opto-Galvanic Effect. Dimensions/NBS, Vol. 62, No. 4, 25-27, April 1978. GPO; \$1.05.
- A Scientist on Capitol Hill. Dimensions/NBS, Vol. 62, No. 5, 2-6, May 1978. GPO; \$1.05.

## B. National Bureau of Standards Interagency Reports

- NBSIR 78-1415 Issen, L.A. Fire Endurance Tests of Residential Wall Containing Branch Circuit Wiring - Preliminary Findings. February 1978. Final Report. NTIS Order No. PB-277536; \$5.25.
- NBSIR 78-1421 Braun, E. Fire Hazard Evaluation of BART Vehicles. March 1978. Final Report. NTIS Order No. PB-281383; \$4.00.
- NBSIR 78-1422 Slater, J.A. Development of a Data Base for Assessing Plastics Fire Hazards. April 1978. NTIS Order No. PB-280027; \$4.50.
- NBSIR 78-1430 Lee, T.G.K. An Instrument to Evaluate Installed Smoke Detectors. February 1978. Final Report. NTIS Order No. PB-278633; \$4.50.
- NBSIR 78-1436 Benjamin, I.A. and Davis, S. Flammability Testing for Carpet. April 1978. Final Report. NTIS Order No. PB-279372; \$4.00.
- NBSIR 78-1438 Loftus, J.J. Back-Up Report for the Proposed Standard for the Flammability (Cigarette Ignition Resistance) of Upholstered Furniture, PFF 6-76. June 1978. Final Report. NTIS Order No. PB-285173; \$9.50.
- NBSIR 78-1440 Issen, L.A. A Literature Review of Fire and Live Load Surveys in Residences. May 1978. Final Report. NTIS Order No. PB-281464; \$4.50.
- NBSIR 78-1448 Moore, L.D. Full-Scale Burning Behavior of Curtains and Drapes. March 1978. Final Report. NTIS Order No. PB-281537; \$4.50.
- NBSIR 78-1484 Pezoldt, V.J. and Van Cott, H.P. Arousal from Sleep by Emergency Alarms: Implications from the Scientific Literature. June 1978. NTIS Order No. PB-284044; \$4.50.
- NBSIR 78-1497 Gross, D. A Preliminary Study of the Fire Safety of Thermal Insulation for Use in Attics or Enclosed Spaces in Residential Housing. July 1978. NTIS Order No. PB-285186; \$4.50.
- NBSIR 78-1502 Bukowski, R.W. Smoke Measurements in Large and Small Scale Fire Testing. October 1978. Final Report. NTIS Order No. PB-287870; \$4.50.
- NBSIR 78-1504 Jason, N.H. Fire Research Publications, 1977. July 1978. Final Report. NTIS Order No. PB-284462; \$4.00.

- NBSIR 78-1511 Quintiere, J.G., McCaffrey, B.J. and DenBraven, K. Experimental and Theoretical Analysis of Quasi-Steady Small-Scale Enclosure Fires. October 1978. Final Report.
- NBSIR 78-1512 Quintiere, J.G. and DenBraven, K. Some Theoretical Aspects of Fire Induced Flows Through Doorways in a Room-Corridor Scale Model. October 1978. Final Report. NTIS Order No. PB-287510; \$4.50.
- NBSIR 78-1514 Stahl, F.I. A Computer Simulation of Human Behavior in Building Fires: Interim Report. September 1978. NTIS Order No. PB-289272; \$7.25.
- NBSIR 78-1522 Klein, D.P. Characteristics of Incidental Fires in the Living Room of a Mobile Home. September 1978. Interim Report. NTIS Order No. PB-291426; \$5.25.
- NBSIR 78-1526 Huggett, C. Annual Conference on Fire Research. December 1978. Final Report. NTIS Order No. PB-291930; \$9.25.
- NBSIR 78-1530 Budnick, E.K. Mobile Home Living Room Fire Studies: The Role of Interior Finish. September 1978. Interim Report. NTIS Order No. PB-291844; \$8.00.
- NBSIR 78-1531 Budnick, E.K., Klein, D.P. and O'Laughlin, R.J. Mobile Home Bedroom Fire Studies: The Role of Interior Finish. September 1978. Interim Report. NTIS Order No. PB-291444; \$6.50.
- NBSIR 78-1555 Nelson, H.E. and Shibe, A.J. A System for Fire Safety Evaluation of Health Care Facilities. November 1978. Final Report. NTIS Order No. PB-292273; \$7.50.

#### C. National Bureau of Standards Technical Notes

- NBS TN 959 Mountain, R.D. and Mulholland, G.W. Calibration of Time Response of Thermometers: Concepts and Model Calculations. January 1978. Final Report. GPO; SD Catalog No. C13.46:959; \$1.40.
- NBS TN 964 Bukowski, R.W., Custer, R.L.P. and Bright, R.G. Fire Alarm Communication Systems. April 1978. GPO; Stock No. 003-003-01914-3; \$2.20.
- NBS TN 973 Bukowski, R.W. and Mulholland, G.W. Smoke Detector Design and Smoke Properties. November 1978. GPO; Stock No. 003-003-01991-7; \$2.30.
- NBS TN 981 Tu, K.M. and Babrauskas, V. The Calibration of a Burn Room for Fire Tests on Furnishings. December 1978. GPO; Stock No. 003-003-01999-2; \$2.30.

### III. Contract and Grant Reports

- AFOSR-IR-78-1008 Kashiwagi, T. and Baum, H.R. Progress Report of Ignition of a Liquid Fuel Under High Intensity Radiation, From May 1, 1977 to April 30, 1978. U.S. Department of the Air Force, Office of Scientific Research. Contract No. AFOSR-ISSA-77-0016. NTIS Order No. AD/A-054974; \$4.50.
- FAA-RD-77-99 Huggett, C. Time-Dependent Fire Behavior of Aircraft Cabin Materials. Final Report. U.S. Department of Transportation, Federal Aviation Administration. Contract No. DOT FA76WAI-610. December 1977.
- NBS-GCR-78-114 Nizamuddin, Z. and Bresler, B. Fire Response of Reinforced Concrete Slabs. University of California, Berkeley. March 1977. NBS Grant No. G7-9006 and NSF Grant No. ERT70-01080. NTIS Order No. PB-284502; \$4.50.
- NBS-GCR-78-115 Iding, R.H., Bresler, B. and Nizamuddin, Z. FIRES-RC-II. A Computer Program for the Fire Response of Structures-Reinforced Concrete Frames (Revised Version). University of California, Berkeley. July 1977. NBS Grant No. G7-9006 and NSF Grant No. ERT70-01080 A05. NTIS Order No. PB-278661; \$9.50.
- NBS-GCR-78-116 Zinn, B.T., Cassanova, R.A., Bankston, C.P., Browner, R.F., Powell, R.A., Rhee, J.U. and Kailasanath, K. Investigation of the Properties of the Combustion Products Generated by Building Fires. October 1, 1976 to September 30, 1977. Georgia Institute of Technology. NBS Grant No. G7-9001. NTIS Order No. PB-276549; \$6.50.
- NBS-GCR-78-117 Fernandez-Pello, A.C. An Experimental Investigation of Flame Spread Over Condensed Combustibles: Gas Phase Interactions. Princeton University. December 1977. NBS Grant No. G7-9004. NTIS Order No. PB-275999; \$4.50.
- NBS-GCR-78-118 Haviland, D.S. Toward a Performance Approach to Life Safety from Fire in Building Codes and Regulations. Rensselaer Polytechnic Institute. January 1978. NTIS Order No. PB-276926; \$9.00.
- NBS-GCR-78-119 Fitzgerald, R.W. Development of Engineering Models and Design Aids to Predict Flame Movement and Fire Severity Within a Room. Worcester Polytechnic Institute. December 1977. NBS Grant No. 5-9019. NTIS Order No. PB-276865; \$6.00.

NBS-GCR-78-120 Bickman, L., Edelman, P. and McDaniel, M. A Model of Human Behavior in a Fire Emergency. Loyola University of Chicago. December 1977. NBS Grant 6-9015. NTIS Order No. PB-277773; \$4.50.

NBS-GCR-78-121 Beyler, C.L. The Interaction of Fire and Sprinklers. University of Maryland. NBS Grant No. 6-9008. September 1977. NTIS Order No. PB-278605; \$6.00.

NBS-GCR-78-126 Durbetaki, P., Tincher, W.C., Chang, H., Ndubizu, C.C., Teague, M.L. and Wolfe, Jr., V.L. Effects of Ignition Sources and Fire Retardants on Material Ignition. Georgia Institute of Technology. March 1978. NBS Grant No. G7-9003. NTIS Order No. PB-281451; \$9.50.

NBS-GCR-78-128 Heskestad, G. and Delichatsios, M.A. Environments of Fire Detectors. Phase 2: Effect of Ceiling Configuration. Volume 1. Measurements. Factory Mutual Research Corporation. FMRC Serial No. 22584. June 1978. Final Report. NBS Grant No. 6-9001. NTIS Order No. PB-290951; \$9.00.

NBS-GCR-78-129 Heskestad, G. and Delichatsios, M.A. Environments of Fire Detectors. Phase 2: Effect of Ceiling Configuration. Volume 2. Analysis. Factory Mutual Research Corporation. FMRC Serial No. 22548. June 1978. Final Report. NBS Grant No. 6-9001. NTIS Order No. PB-284042; \$6.50.

NBS-GCR-78-135 McDaniel, M.A., Bickman, L., Edelman, P. and Herz, E. An Exploration of Non-Sampling Error in Fire Incident Survey. Loyola University of Chicago. December 1977. NBS Grant No. 6-9015. NTIS Order No. PB-284849; \$4.00.

NBS-GCR-78-136 McDaniel, M.A., Bickman, L., Edelman, P. and Herz, E. A Survey of Fire Preparedness in a Midwestern City. Loyola University of Chicago. December 1977. NBS Grant No. 6-9015. NTIS Order No. PB-285458; \$5.25.

NBS-GCR-78-137 Herz, E., Edelman, P. and Bickman, L. The Impact of Fire Emergency Training on Knowledge of Appropriate Behavior in Fires. Loyola University of Chicago. January 1978. NBS Grant No. 6-9015. NTIS Order No. PB-285472; \$4.50.

NBS-GCR-78-138 Bryan, J.L. Human Behavior in Fire - A Bibliography. University of Maryland. August 1978. NBS Grant No. 7-9014. NTIS Order No. PB-287412; \$4.50.

|                |                                                                                                                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NBS-GCR-78-140 | Bryan, J.L. and DiNenno, P.J. An Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at St. Joseph's Hospital, Philadelphia, Pa. on August 10, 1978. University of Maryland. May 31, 1978. NBS Grant No. 7-9014. NTIS Order No. PB-287935; \$5.25. |
| NBS-GCR-78-147 | Bankston, C.P., Cassanova, R.A., Powell, E.A. and Zinn, B.T. Review of Smoke Particulate Properties Data for Burning Natural and Synthetic Materials. Georgia Institute of Technology. May 1978. NBS Grant No. G8-9003. NTIS Order No. PB-292066; \$5.25.                          |
| NBS-GCR-78-149 | Shelton, J.W. Analysis of Fire Reports on File in the Massachusetts State Fire Marshal's Office Relating to Wood and Coal Heating Equipment. November 1978. NBS Contract No. NB79NAAA1576. NTIS Order No. PB-292521; \$4.00.                                                       |
| NBS-GCR-78-150 | Liu, V.K. and Yang, K.T. UNSAFE-II - A Computer Code for Buoyant Turbulent Flow in an Enclosure With Thermal Radiation. University of Notre Dame. July 15, 1978. NBS Grant No. G7-9002. NTIS Order No. PB-291516; \$8.00.                                                          |
| NBS-GCR-78-151 | Liu, V.K. and Lloyd, J.R. One Dimensional Radiation Model for Surfaces and Non-Homogeneous Gases and Soot. University of Notre Dame. March 1978. NBS Grant No. G7-9002, Mod. 1. NTIS Order No. PB-291099; \$6.00.                                                                  |
| NBS-GCR-78-152 | Nee, V.W. and Liu, V.K. An Algebraic Turbulence Model for Buoyant Recirculating Flow. University of Notre Dame. May 1978. NBS Grant No. G7-9002, Mod. 1.                                                                                                                           |

# IV. Author Index

## A

Ahmad, T., 1  
Alarie, Y.C., 1, 4  
Anderson, R.C., 1

## B

Babrauskas, V., 6  
Bankston, C.P., 1, 7, 9  
Barrow, C.S., 1  
Baum, H.P., 3, 7  
Benjamin, I.A., 1, 5  
Beyler, C.L., 8  
Bickman, L., 8  
Braun, E., 5  
Breden, L.H., 2  
Bresler, B., 7  
Bright, R.G., 1, 6  
Brown, N.J., 1  
Brown, R.F., 1, 2, 7  
Bryan, J.L., 8, 9  
Budnick, E.K., 6  
Bukowski, R.W., 5, 6  
Bushev, V.P., 2

## C

Cassanova, R.A., 7, 9  
Chabay, P., 4  
Chaffee, D., 4  
Chang, H., 8  
Chien, J.C.W., 2  
Chow, L.C., 2  
Crim, F.F., 4  
Custer, R.L.P., 6

## D

Davis, S., 2, 5  
Delichatsios, M.A., 8  
DenBraven, K., 6  
Dierdorf, J., 1  
DiNenno, P.J., 9  
Durbetaki, P., 8

## E

Eberius, K.H., 1  
Edelman, P., 8  
Evans, D.D., 2

## F

Faeth, G.M., 1, 3  
Fedorenko, V.S., 2  
Fernandez-Pello, A.C., 7  
Fitzgerald, R.W., 7  
Fristrom, R.M., 1, 2

## G

Gross, D., 2, 5

## H

Haviland, D.S., 7  
Herz, E., 8  
Heskestad, G., 8  
Heyman, M., 4  
Hoyeremann, K.H., 1  
Huggett, C., 6, 7

## I

Iding, R.H., 7  
Issen, L.A., 5

## J

Jason, N.H., 5

## K

Kailasanath, K., 7  
Kashiwagi, T., 2, 3, 4, 7  
Kauffman, C.W., 2  
Keller, R.A., 4  
Kiang, J.K.Y., 2  
King, D.S., 3, 4  
Klein, D.P., 6

## L

Lai, Y.Z., 4  
 Lee, T.G.K., 5  
 Levin, B., 2  
 Levine, R.S., 3  
 Liao, J.C., 2  
 Liburdy, J.A., 3  
 Liu, V.K., 9  
 Lloyd, J.R., 9  
 Loftus, J.J., 5  
 Lyons, J.W., 3

## M

Magill, J., 4  
 Mallard, W.G., 3  
 Manka, M., 3  
 Matijak, M., 1  
 McCaffrey, B.J., 3, 6  
 McCarter, R.J., 3  
 McDaniel, M.A., 8  
 McIntyre, C.R., 4  
 Miles, L.B., 3  
 Moore, L.D., 5  
 Mountain, R.D., 6  
 Mulholland, G.W., 6

## N

Ndubizu, C.C., 8  
 Nee, V.W., 9  
 Nelson, H.E., 6  
 Nicholls, J.A., 2  
 Nizamuddin, Z., 7

## O

O'Laughlin, R.J., 6

## P

Pchelintsev, V.A., 2  
 Pezoldt, V.J., 5  
 Powell, E.A., 1, 9  
 Powell, R.A., 7

## Q

Quintiere, J.G., 3, 6

## R

Rehm, R.G., 3  
 Rhee, J.U., 7  
 Rinkinen, W., 3  
 Rosasco, G.J., 4  
 Rowen, J.W., 3

## S

Sawin, R., 1  
 Schenck, P.K., 3, 4  
 Sebata, K., 4  
 Shafizadeh, F., 4  
 Shelton, J.W., 9  
 Shibe, A.J., 6  
 Slater, J.A., 5  
 Smith, B.F., 3  
 Smyth, K.C., 3, 4  
 Stahl, F.I., 6  
 Stock, M.F., 1

## T

Teague, M.L., 8  
 Tien, C.L., 2  
 Tincher, W.C., 8  
 Travis, J.C., 3, 4  
 Tu, K.M., 6  
 Turk, G.C., 3

## U

Ural, E., 2

## V

VanCott, H.P., 5  
 VanDyk, R., 2  
 Vreeland, R., 2

W

Wagner, H.Gg., 1  
Wolfe, Jr., V.L., 8

Y

Yakovlev, A.J., 2  
Yang, K.T., 9  
Yeh, K., 3

Z

Zinn, B.T., 1, 7, 9

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                         |                                                  |                                       |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------|--------------------------------------------------|---------------------------------------|---------|--------------|----------------|--------------|--------|------|--------------|--|--------------|--------|------|--------------|--|--------------|--------|------|---------------|--|-----------|--------|------|---------------|--|-----------|--------|------|---------------|--|-----------|--------|
| U.S. DEPT. OF COMM.<br>BIBLIOGRAPHIC DATA<br>SHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               | 1. PUBLICATION OR REPORT NO.<br><br>NBSIR 79-1745       | 2. Gov't. Accession No.                          | 3. Recipient's Accession No.          |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 4. TITLE AND SUBTITLE<br><br>Fire Research Publications, 1978                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                                                         | 5. Publication Date<br><br>April 1979            |                                       |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                         | 6. Performing Organization Code                  |                                       |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 7. AUTHOR(S)<br><br>Nora H. Jason                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                         | 8. Performing Organ. Report No.                  |                                       |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br><br>NATIONAL BUREAU OF STANDARDS<br>DEPARTMENT OF COMMERCE<br>WASHINGTON, DC 20234                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                         | 10. Project/Task/Work Unit No.                   |                                       |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                         | 11. Contract/Grant No.                           |                                       |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 12. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP)<br><br>Same as No. 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                                                         | 13. Type of Report & Period Covered<br><br>Final |                                       |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                         | 14. Sponsoring Agency Code                       |                                       |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 15. SUPPLEMENTARY NOTES<br><br><input type="checkbox"/> Document describes a computer program; SF-185, FIPS Software Summary, is attached.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                                         |                                                  |                                       |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)<br><br>"Fire Research Publications, 1978" is a supplement to the previous edition:<br><br><table border="0"> <tr> <td>1969-72</td> <td>NBSIR 73-246</td> <td>NTIS Order No.</td> <td>COM-74-10989</td> <td>\$3.25</td> </tr> <tr> <td>1973</td> <td>NBSIR 74-511</td> <td></td> <td>COM-74-11448</td> <td>\$3.25</td> </tr> <tr> <td>1974</td> <td>NBSIR 75-736</td> <td></td> <td>COM-75-11018</td> <td>\$3.25</td> </tr> <tr> <td>1975</td> <td>NBSIR 76-1120</td> <td></td> <td>PB-257837</td> <td>\$3.50</td> </tr> <tr> <td>1976</td> <td>NBSIR 77-1277</td> <td></td> <td>PB-269965</td> <td>\$3.50</td> </tr> <tr> <td>1977</td> <td>NBSIR 78-1504</td> <td></td> <td>PB-284462</td> <td>\$4.00</td> </tr> </table><br>Only publications prepared by members of the Center for Fire Research (CFR), by other National Bureau of Standards (NBS) personnel or external laboratories under contract or grant from CFR are cited. Articles published in NBS house organs also are cited. |               |                                                         |                                                  |                                       | 1969-72 | NBSIR 73-246 | NTIS Order No. | COM-74-10989 | \$3.25 | 1973 | NBSIR 74-511 |  | COM-74-11448 | \$3.25 | 1974 | NBSIR 75-736 |  | COM-75-11018 | \$3.25 | 1975 | NBSIR 76-1120 |  | PB-257837 | \$3.50 | 1976 | NBSIR 77-1277 |  | PB-269965 | \$3.50 | 1977 | NBSIR 78-1504 |  | PB-284462 | \$4.00 |
| 1969-72                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | NBSIR 73-246  | NTIS Order No.                                          | COM-74-10989                                     | \$3.25                                |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 1973                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NBSIR 74-511  |                                                         | COM-74-11448                                     | \$3.25                                |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 1974                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NBSIR 75-736  |                                                         | COM-75-11018                                     | \$3.25                                |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 1975                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NBSIR 76-1120 |                                                         | PB-257837                                        | \$3.50                                |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 1976                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NBSIR 77-1277 |                                                         | PB-269965                                        | \$3.50                                |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 1977                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NBSIR 78-1504 |                                                         | PB-284462                                        | \$4.00                                |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 17. KEY WORDS (six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)<br>Arson; bibliographies; building fires; compartment fires; fabric flammability; fire detection systems; fire tests; flammability tests; human behavior; plastics; polymers; smoke; smoke detectors; subway fires; toxicity; upholstered furniture.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                                                         |                                                  |                                       |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
| 18. AVAILABILITY<br><br><input checked="" type="checkbox"/> Unlimited<br><br><input type="checkbox"/> For Official Distribution. Do Not Release to NTIS<br><br><input type="checkbox"/> Order From Sup. of Doc., U.S. Government Printing Office, Washington, DC 20402, SD Stock No. SN003-003-<br><br><input checked="" type="checkbox"/> Order From National Technical Information Service (NTIS), Springfield, VA. 22161                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               | 19. SECURITY CLASS<br>(THIS REPORT)<br><br>UNCLASSIFIED |                                                  | 21. NO. OF<br>PRINTED PAGES<br><br>16 |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               | 20. SECURITY CLASS<br>(THIS PAGE)<br><br>UNCLASSIFIED   |                                                  | 22. Price<br><br>\$4.00               |         |              |                |              |        |      |              |  |              |        |      |              |  |              |        |      |               |  |           |        |      |               |  |           |        |      |               |  |           |        |





